AN UPPER PANNONIAN s. l. (MIOCENE) MOLLUSC FAUNA FROM FEHÉRVÁRCSURGÓ (HUNGARY)

by

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Abstract

An exposure of Kálla and Somló Formations (Pannonian s. l.) has been studied in Fehérvárcsurgó, NW of Székesfehérvár, Hungary. The section reveals sandy and silty layers deposited in offshore-bars and open lake environments, containing a mollusc fauna belonging to the "Congeria ungulacaprae horizon" and dark, huminitic layers formed in back-lagoon environments, characterized with dominance of freshwater and terrestrial fossils. Remarks on some characteristic mollusc species, such as *Congeria ungulacaprae* (MÜNSTER), *Dreissena auricularis* (FUCHS) *Unio mihanovici* (BRUSINA), *Lymnocardium apertum* (MÜNSTER), *Lymnocardium penslii* (FUCHS), *Lymnocardium variocostatum* (VITÁLIS), *Theodoxus intracarpaticus* (JEKELIUS), *Theodoxus* aff. *soceni* (JEKELIUS), *Melanopsis kupensis* (FUCHS), *Melanopsis* aff. *impressa* KRAUSS), *Valvata* aff. *varians* (LŐRENTHEY) and *Gyraulus inornatus* (BRUSINA) are given.

Introduction

At the early stage of the study of Pannonian and Pontian biostratigraphy, mainly species of *Congeria* were used as index fossils. LŐRENTHEY introduced the term "*Congeria ungulacaprae* horizon" as a biozone in the lowest part of the Upper Pannonian s. 1. The Kúp section (FUCHS 1870) can be regarded as its classical exposure. STRAUSZ, who had mapped the western foreland of the Transdanubian Range, listed a lot of localities and the characteristic species of this zone (STRAUSZ 1942/a).

In fact, *Congeria ungulacaprae* has a wider stratigraphic range than the zone named after it. It first appears in the Pannonian s. str. with species like *Congeria czjzeki, Congeria partschi, Congeria subglobosa, Lymnocardium soproniense.* On the other hand, it may also occur in the much younger *Congeria balatonica* beds (e. g. in Tihany). In principle, the intermediate "*Congeria ungulacaprae* horizon" ought to be marked with species that seem to be confined to this zone, such as *Lymnocardium variocostatum, "Lymnocardium" priscae, Melanopsis* aff. *impressa* or *Melanopsis kupensis.* However, shells of *Congeria ungulacaprae* are much more common than those of the above species, due to its mass appearance and the good preservation potential of its often thick umbo. Thus, from a practical point of view, it seems best to insist on the traditional nomenclature until we better understand the stratigraphic conditions of the Pannonian s. l.

KORPÁS-HÓDI (1983) described the *Melanopsis pygmaea-Lymnoardium penslii* palaeoassociation (or, rather, thanatocoenosis) from the northern foreland of the Transdanubian Range. The Fehérvárcsurgó fauna can be well assigned to both these stratigraphic and ecological units. Its great similarity to the faunas of Kúp (FUCHS 1870), Kocs (VITÁLIS 1934), Dáka, Pápa, Tüskevár, Tapolca (STRAUSZ 1942/a), Tataros (= Brusturi, Rumania; STRAUSZ 1942/b) and Lázi (STRAUSZ 1942/a, BARTHA 1963) must indicate that all of them are about of the same age. According to K-Ar ages from Tihany (MÜLLER et SZÓNOKY 1988), their estimated age is between 8 and 9 Ma.

Geologic setting

The Fehérvárcsurgó quartz sand pit is situated in the northeastern foreland of the Bakony Mts., 13 km NW of Székesfehérvár. The sandy formations of the Pannonian s. l., which follow the edge of the mountains, outline an embayment here, extending 3 km northeastward (BIHARI, pers. comm.).

The white quartz sand (Kálla Formation) rests partly on Upper Triassic dolomite; where the Traissic is situated deeper, the underlying rocks are Cretaceous bauxite and bauxitic clay, Eocene marl and limestone, Oligocene-Miocene clay and older Pannonian clay (VECSERNYÉS 1966). The overlying silt and sandy silt beds (Somló Formation) contain a mollusc fauna belonging to the "*Congeria ungulacaprae* horizon". As the layers gently dip southeastward, the presence of the *Congeria balatonica* beds (Tihany Formation) can be assumed on the top of the Somló Formation in the southeast (see faunal list by VECSERNYÉS 1966). In the studied exposure Somló Formation is overlain by Pleistocene or Holocene sand and gravel.

Sedimentology and ecology

The Kálla Formation and the overlying Somló Formation seem to belong to one depositional unit. Both contain black, huminitic layers that were formed in marshy back-lagoons separated from the open lake by well-sorted sand bars. Due to horizontal shifting of the different environments, huminitic layers appear both in the white sand and the overlying beds of coarse silt and fine sand. The latter ones, containing pebbles, carbonates and mica were deposited shoreward of the central white sand zone (BIHARI 1985).

The section reveals the following layers *(Fig. 1)*:

Layer 1 consists of very well-sorted, fine-grained quartz sand with brown, limonitic stripes and pisiform concretions. It represents the central part of the offshore bars, indicating intensive wave action. Layer 2 with limonitic, poorly sorted, sandy coarse silt and mica may represent the shoreward side of the bars.

Layer 4 consists of finely laminated, sometimes crossbedded, dark huminitic silt with a great amount of small shell fragments. Its lower part (Layer 3) is red, probably due to subsequent oxidation. They suggest a shallow water, backlagoon environment overgrown by water-plants. Plant remains, such as *Stratiotes* sp. are common. Freshwater and terrestrial molluscs (*Lymnaea* sp., *Radix* sp., Limacidae sp., *Planorbarius* cf. *corneus*, *Cepaea* sp., Helicidae sp.) are prevailing. *Congeria* cf. *neumayri*, *Theodoxus* aff. *soceni*, *Melanopsis sturii* and opercula of *Bithynia* are also common. Only a few shells of ostracods were found.

In Layer 5, the increasing ratio of bivalves to gastropods and the presence of species of *Melanopsis* with large body size argue for the deepening of the water and a well-aerated environment. The grey, poorly sorted silt contains sandy lenses. Characteristic molluscs are *Melanopsis pygmaea*, *Melanopsis* aff. *impressa*, *Melanopsis kupensis*, *Melanopsis sturii*, *Unio mihanovici*, *Lymnocardium penslii*, *Lymnocardium variocostatum*, *Gyraulus inornatus*, *Valvata* aff. *varians* and juvenile forms of *Dreissena*. As for ostracods, species of genera *Amplocypris*, *Cyprideis* and *Hemicytheria* are common. The finds of Helicidae sp. indicate near-shore deposition.

Layer 6 consists of well-sorted coarse silt with carbonate nodules. A few fragments of shells and one specimen of *Unio mihanovici* were found in it. A protected lagoon environment can be assumed for Layer 7. In the base of the dark, huminitic layer eroded shells of *Congeria ungulacaprae* can be found. They were washed in from a high-energy environment. The autochthonous molluscs were species of Planorbidae.

Layer 8 consists of grey, poorly sorted, coarse silt, containing thin, well-sorted, very fine-grained sand beds. Byssus-anchored bivalves are prevailing in the fauna. The mass appearance of *Congeria ungulacaprae* in the lowermost sandy bed (Layer 8/a) indicates well-aerated, strongly agitated water. As a low-energy environment was re-established, *Congeria ungulacaprae* retreated

from this area. The bottom became covered with shells of *Dreissena auricularis*. The increasing current velocity offered favourable circumstances again for *Congeria ungulacaprae*, but it failed to return probably in the absence of free substratum. *Melanopsis pygmaea, Lymnocardium penslii, Lymnocardium*

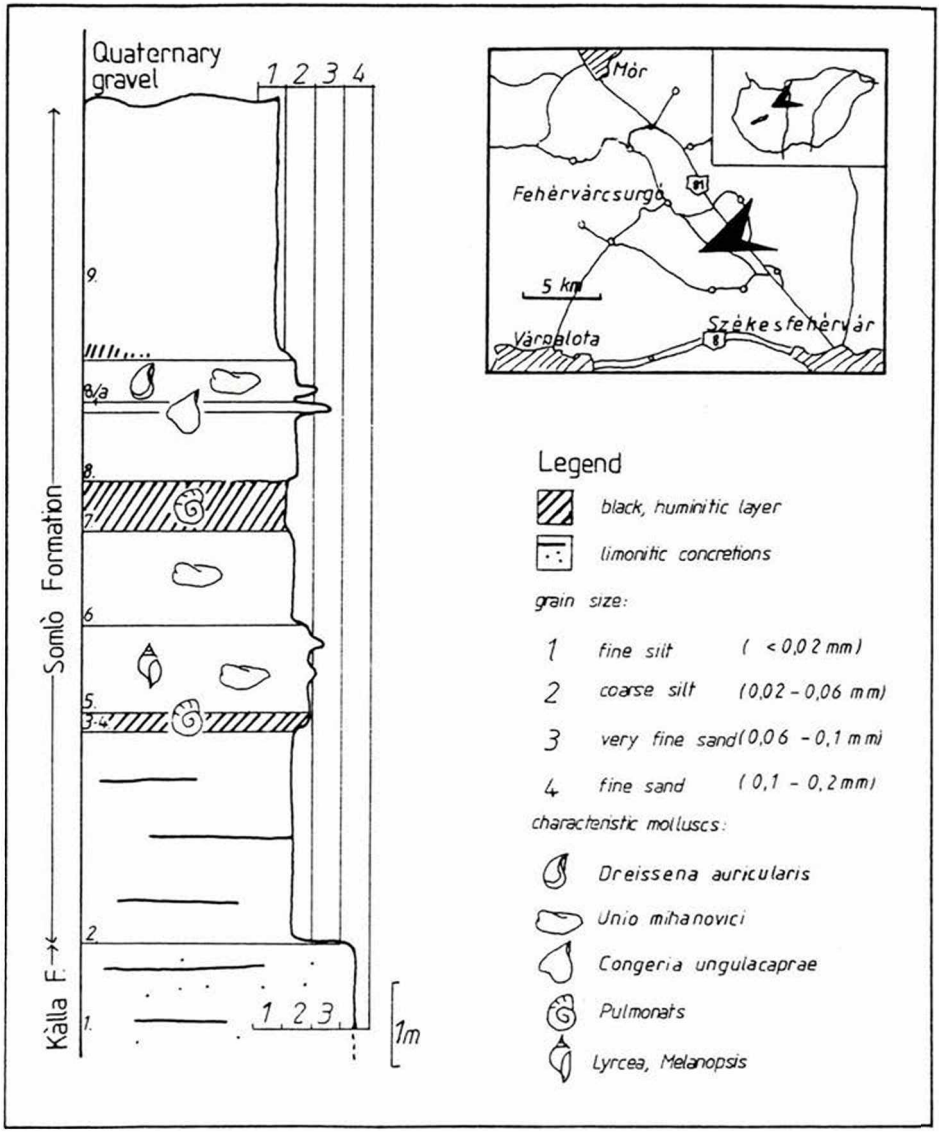

Fig. 1.

apertum, Unio mihanovici and ostracods, such as *Amplocypris, Candona, Bacunella, Leptocythere, Hemicytheria, Loxoconcha* and *Cyprideis* are common in Layer 8. Low number of gastropods indicate deeper water environment.

Layer 9 consists of clayey fine silt with sandy beds containing extremely poorly preserved shells. On the top of the Pannonian s. l. sequence, Pleistocene or Holocene layers of gravel and sand rest with erosional unconformity.

Molluscs

The following forms were determined from the section:

	layer					
Bivalvia	3-4	5	6	7	8	8/a
Congeria ungulacaprae (MÜNSTER)				(x)		x
Congeria cf. *neumayri* ANDRUSOV	x	x				
Dreissena auricularis (FUCHS)		x			x	
Unio mihanovici BRUSINA	x	x	x		x	
Lymnocardium apertum (MÜNSTER)		x				x
Lymnocardium cf. *trifkovici* BRUSINA		x				
Lymnocardium penslii (FUCHS)		x			x	
Lymnocardium variocostatum VITÁLIS		x				
Protoplagiodacna cf. *chyzeri* (BRUSINA)		x				
Gastropoda						
Theodoxus intracarpaticus JEKELIUS		x				
Theodoxus aff. *soceni* JEKELIUS	x					
Valvata aff. *varians* LŐRENTHEY		x				
Valvata kupensis FUCHS		x				
Valvata cf. *minima* FUCHS	x					
Valvata sp.	x					
Bithynica cf. *jurinaci* BRUSINA	x					
Prososthenia sp.		x				
Micromelania sp.		x				
Pyrgula sp.		x				
Melanopsis pygmaea PARTSCH		x			x	x
Melanopsis struii FUCHS	x	x				
Melanopsis aff. *impressa* KRAUSS		x				
Melanopsis kupensis FUCHS		x				
Gyraulus inornatus (BRUSINA)		x				
Gyraulus sp.	x					
Radix sp.	x					
Lymnaea sp.	x					

	layer					
	3-4	5	6	7	8	8/a
Planorbarius cf. *corneus* (LINNÉ)	x					
Planorbidae sp.				x		
?*Anisus confusus* SOÓS	x					
Cepaea sp.	x					
Helicidae sp.	x	x				
Limacidae sp.	x					

Without full description, I give remarks on several forms, the majority of which is characteristic for the "*Congeria ungulacaprae* horizon".

Congeria ungulacaprae (MÜNSTER, 1839)
(Pl. 1, fig. 1-4)

1835 *Congeria triangularis* n. sp. - PARTSCH, pl. XII, fig. 1-4
1870 *Congeria triangularis* PARTSCH - M. HÖRNES, pl. 48, fig. 1,3.
1870 *Congeria Balatonica* PARTSCH var. *crassitesta* - FUCHS, pl. XXII, fig. 15, 16.
1875 *Congeria balatonica* PARTSCH var. *crassitesta* FUCHS - R. HÖRNES, pl. II, fig. 1,2.
1886 *Congeria ungula caprae* MÜNSTER - HALAVÁTS, text-fig. 2, pl. XXVI, fig. 4.
1897 *Congeria ungula caprae* (non MÜNSTER) - ANDRUSOV, Pl. V, Fig. 18-22.
1897 *Congeria hörnesi* BRUSINA - ANDRUSOV, pl. VI, fig. 1-3, 6-7
?1902 *Congeria ungula caprae* (MÜNSTER) - BRUSINA, pl. XVIII, fig. 32-38
1902 *Congeria ungula-caprae* MÜNSTER - LŐRENTHEY, pl. XIX, fig. 1-5, pl. XX, fig. 1-3
1903 *Congeria ungula caprae* MÜNSTER - HALAVÁTS, text-fig. 7.
1910 *Congeria ungula caprae* MÜNSTER - VITÁLIS, text-fig. 1, 3, 4, 7 pl. I, pl. II, fig. 1-3.
1953 *Congeria hoernesi* BRUSINA - PAPP, pl. 15, fig. 6,7
?1953 *Congeria ungula caprae* MÜNSTER - PAPP, pl. 15, fig. 8,9
1971 *Congeria ungulacaprae* MÜNSTER - BARTHA, pl. XXVII, fig. 1, 2
1971 *Congeria hörnesi* BRUSINA - BARTHA, pl. XXIV, fig. 1.

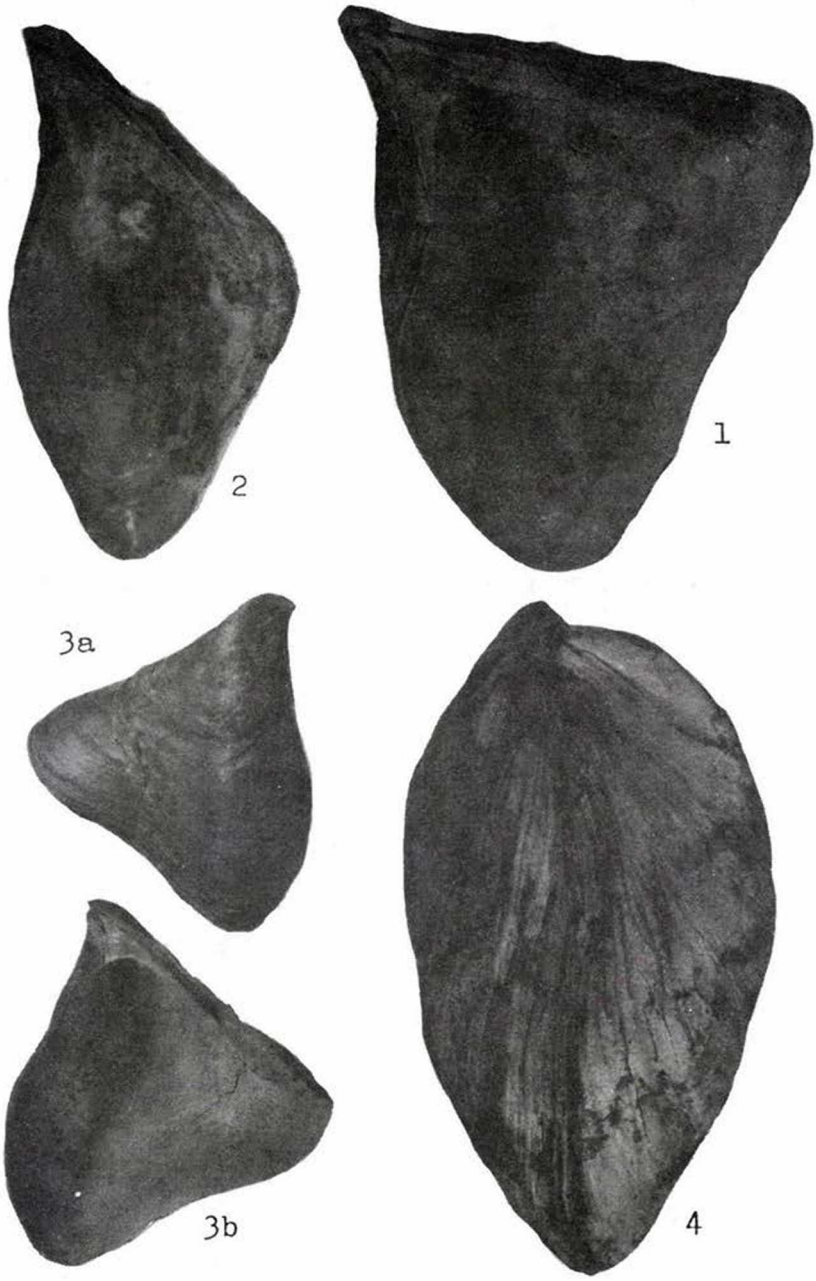

Plate I.

Fig. 1-4. *Congeria ungulacaprae* (MÜNSTER 1839) (fig. 2-3: 0.75 x)

It is a well-known and often referred species, the long history of recognition and distinction of which was described by VITÁLIS (1910) in detail. In the synonymy above I have tried to collect only the figures of the species that had been published since the description of genus Congeria (PARTSCH 1835).

Attempts to separate new species or subspecies of this form, based on the outline of the shell, on the sharpness of the anteroventral edge, on the thickness of the umbo or on any other feature (BRUSINA 1892, LŐRENTHEY 1902, VITÁLIS 1910) resulted in confusion. For example, specimens of *Congeria ungulacaprae* from Sopron are called *Congeria hoernesi,* in spite of the fact that they show no diagnostic difference with specimens from other localities.

Congeria ungulacaprae is a very variable species indeed. While the outline of the shell displays great variety in a given layer, partly because it lived in crowded colonies, the thickness of the umbonal region, however, does not. It must have ecological reasons. The young individual, in a given growth stage, closed its byssal notch in order to change for a recliner mode of life (SEILACHER, 1984). It continued the deposition of shell material in the umbonal region until it was able to stabilize the shell by its weight on the substratum. This might explain why the thickness of the shell vary from place to place. I measured the ratio of the shell cavity to the whole shell volume in order to express the relative shell thickness. It was 0,65 in a Fehérvárcsurgó specimen and 0,28 in a Somló-hegy specimen. However, taking into account other localities, we find continuous series of transition between these two extreme forms.

Shells of *Congeria ungulacaprae,* often in life position, can be foound in Layer 8/a of the Fehérvárcsurgó section.

Dreissena auricularis (FUCHS 1870)
(Pl. 2, fig. 1-3)

1870 *Congeria auricularis* FUCHS - FUCHS, p. 547, pl. XXII, fig. 26-28.
1897 *Dreissena auricularis* FUCHS f. *typica* - ANDRUSOV, p.2 43, pl. XIII, fig. 1-5.
1951 *Dreissena auricularis* FUCHS f. *typica* - STEVANOVIC, p. 215 pl. III, fig. 7.
1959 *Dreissena auricularis* FUCHS - BARTHA, pl. XII, fig. 5,6.
1963 *Dreissena auricularis* FUCHS - BARTHA, pl. III, fig. 3, pl. IV, fig. 3.
1971 *Dreissena auricularis* FUCHS - TÓTH, pl. II, fig. 6,7, pl. IV, fig. 1.

The type locality of the species is Kúp. Though the Fehérvárcsurgó specimens are variable concerning the outline of the shell, the pointedness of the beak and the sharpness of the edge running from the beak ventralward, they can be taken as typical forms.

Adult specimens can be found in Layer 8. They covered the bottom in such a mass that prevented other molluscs from settling down.

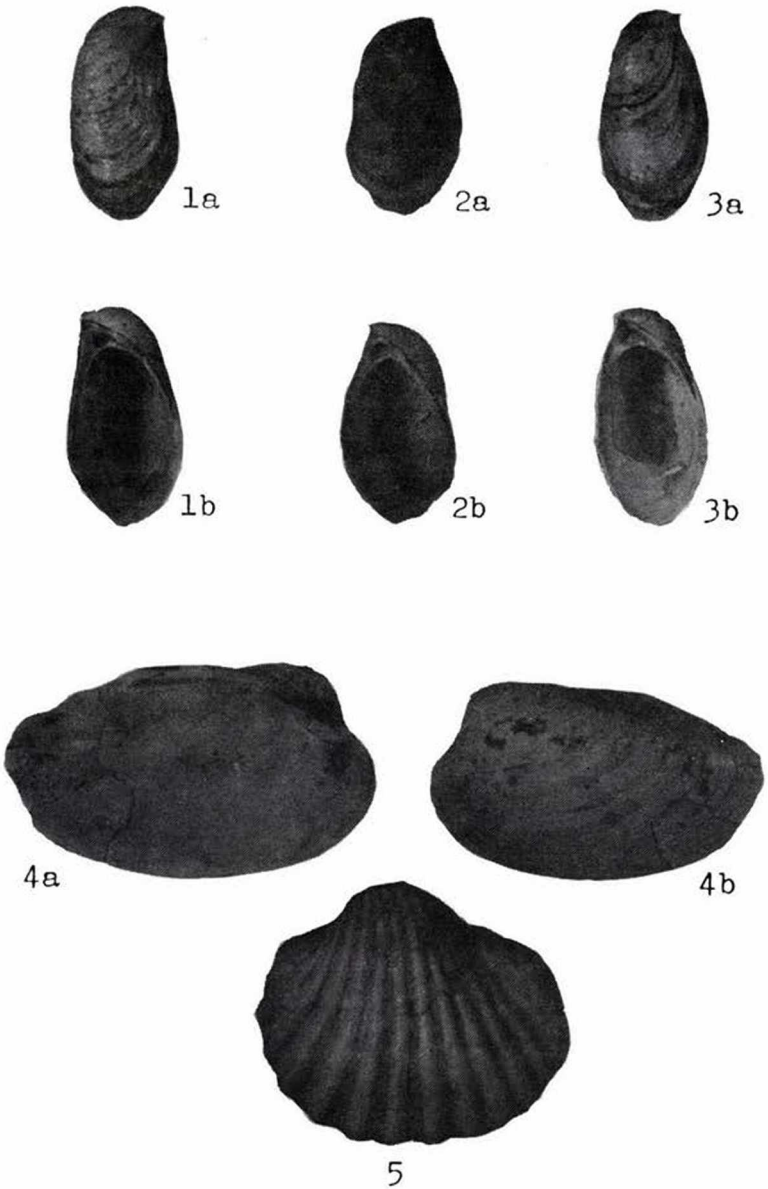

Plate II.

Fig. 1-3. *Dreissena auricularis* (FUCHS 1870). 1.5x Fig. 4. *Unio mihanovici* BRUSINA 1896, Fig. 5. *Lymnocardium apertum* (MÜNSTER 1839) 1.5 x

Unio mihanovici BRUSINA 1896
(Pl. 2, fig. 4)

1896 *Unio mihanovici* n. n. - BRUSINA, p. 148
(cum syn. MÜLLER et SZÓNOKY in prep.)

The revision of this species has recently been performed by MÜLLER (MÜLLER-SZÓNOKY in prep.). A lot of specimens, identified as *"Unio atavus"*, must belong here.

Unio mihanovici is rather common both in the "*Congeria ungulacaprae* horizon" and in the *Congeria balatonica* beds. In Fehérvárcsurgó, almost all of the fossiliferous layers contain its opened or closed shells.

Though present-day species of *Unio* are freshwater forms, this Pannonian s. l. species, often appearing with masses of *Lymnocardium*, seems to be rather tolerant of changing salinity. Thus, the application of actualism in palaeoecological reconstructions require great caution.

Lymnocardium (Lymnocardium) apertum (MÜNSTER 1839)
(Pl. 2, fig. 5)

1839 *Cardium apertum* MÜNSTER in GOLDFUSS, p. 223, pl.1 35, fig. 8.
(cum syn. MARINESCU 1973, p. 11)

Lymnocardium apertum is a remarkably variable species. In the Fehérvárcsurgó section, a rather depressed, posteriorly elongated variant with sharp ribs is prevailing.

It is common in Layer 8/a with *Congeria ungulacapreae.*

Lymnocardium (Pannonicardium) penslii (FUCHS 1870)
(Pl. 3, fig. 1-3)

1870 *Cardium Penslii* FUCHS - FUCHS, p. 355, pl. XV, fig. 15-17
1902 *Limnocardium Penslii* (FUCH) - BRUSINA, pl. XXIX, fig. 46, 47
1902 *Limnocardium Penslii* FUCHS - LŐRENTHEY, p. 265, pl. XIX, fig. 7, pl. XXI, fig. 4,5
1903 *Limnocardium penslii* FUCHS - ANDRUSOV, pl. V, fig. 7,8
1951 *Pannonicardium penslii* FUCHS - STEVANOVIC, p. 239, pl. IV, fig. 1-3.

1963 *Limnocardium penslii* FUCHS - BARTHA, pl. III, fig. 5, pl. IV, fig. 2.
1971 *Limnocardium (Pannonicardium) penslii* (FUCHS) GILLET et MARINESCU p. 21, pl. VI, fig. 9, 10
? 1980 *Limnocardium penslii* (FUCHS) - LUEGER, p. 112, pl. 4, fig. 5

This species has a rather well defined character, its distinction has raised problems only from its descendants, that is, other species of subgenus *Pannonicardium*, such as *Lymnocardium variocostatum* and *Lymnocardium schmidti*. I think that, in most of the cases, they can be easily separated using their original description.

The "variation" of *Lymnocardium penslii* rather seems to be an evolutionary pattern: While it is smaller, having broader ribs set closely side by side in the older "*Congeria ungulacaprae* horizon" (Kúp, Fehérvárcsurgó), it is usually larger with narrower ribs is the younger *Congeria balatonica* beds (Tihany, Radmanest). This difference has already been noted by FUCHS (1870, p. 547).

This species can be found in great number in Layers 5 and 8.

Lymnocardium (Pannonicardium) variocostatum VITÁLIS 1934
(Pl. 3, fig. 4.)

1934 *Limnocardium vario-costatum* n. sp. - VITÁLIS, p. 696, pl. VI, fig. 1-4
1942 *Limnocardium Penslii variocostatum* VITÁLIS - STRAUSZ, p. 68
1963 *Limnocardium penslii variocostatum* (VITÁLIS) - BARTHA, pl. II, fig. 1, pl. IV, fig.1
1971 *Limnocardium variocostatum* VITÁLIS - BARTHA, pl. XXXII, fig. 3, 6

Only a few intact specimens of this species are known. Fragmentary specimens have been found mainly in the western foreland of the Transdanubian Range. Its type locality is Kocs.

Besides the fragments, a nearly intact left valve was found is Fehérvárcsurgó (Layer 5). The dimensions of the oval valve exceed those of the type specimen; its original length was well over 7 cm. As the anterior and dorsal margins are set at a right angle, the anterodorsal auricle, which was considered to be a specific character by VITÁLIS, is missing here. In addition, the edge of the anterior ribs is less marked than in the type specimen.

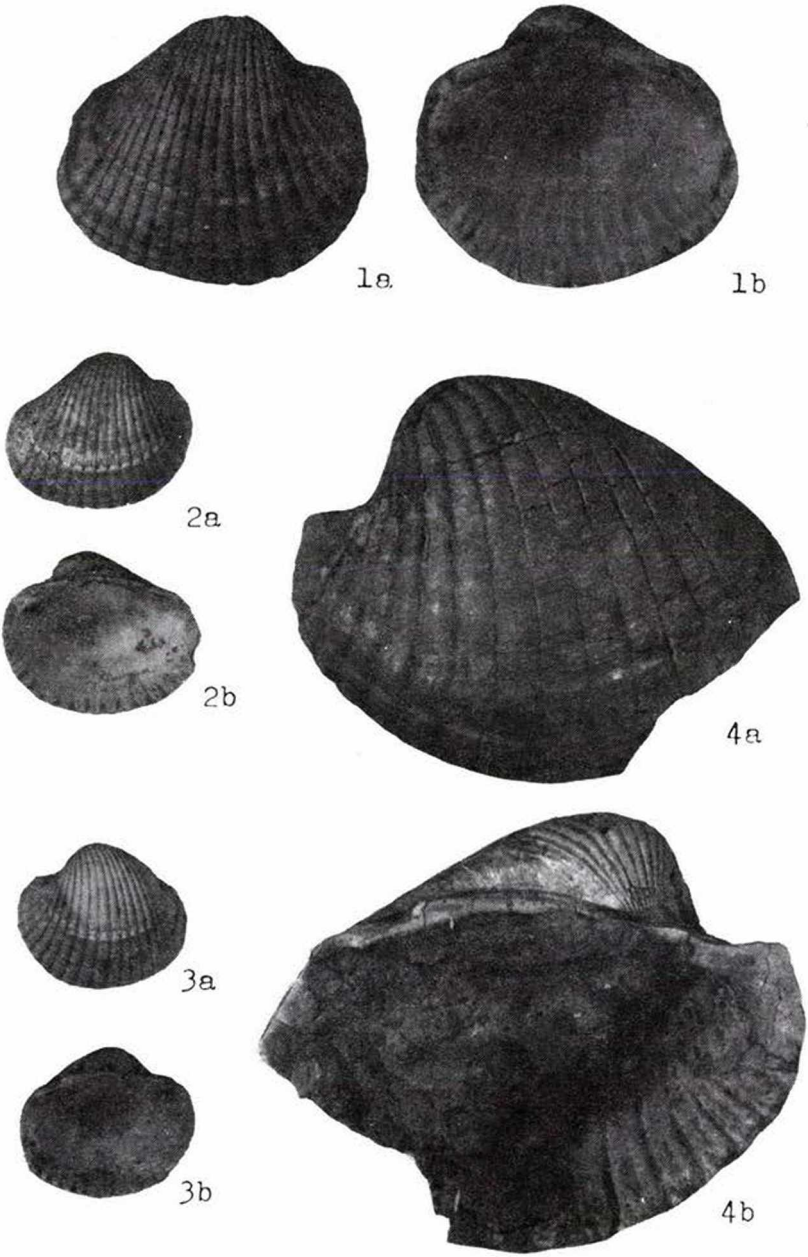

Plate III.

Fig. 1-3. *Lymnocardium penslii* (FUCHS 1870) Fig. 1 : 1.5x

Fig. 4. *Lymnocardium variocostatum* VITÁLIS 1934.

Theodoxus intracarpaticus JEKELIUS 1944
(Pl. 4, fig. 1-3)

1944 *Theodoxus intracarpaticus* n. sp. - JEKELIUS, p. 112, pl. 41, fig. 1-24
1953 *Theodoxus (Theodoxus) intracarpaticus* JEKELIUS - PAPP, p. 97, pl. 2, fig. 4-11

The small specimens are slim, subtriangular in outline, the larger ones are wide and oval. The labial area is usually strongly convex; its outer margin is arched, the inner one is straight or slightly, adaxially curved in the middle; it is dentate only in few specimens. However, once it is dentate, the denticles are rather well developed.

Colour ornamentation of smaller specimens agrees fairly well with that of the form figured by PAPP (1953, pl. 2, fig. 9 and 10). The white ground is covered with square, light brown spots and, in 4 spiral zones, with smaller, dark brown spots. The ornamentation of the larger specimens is different: it is fine, dark brown network on brown ground. They wear strong varices near the aperture.

A form with similar ornamentation was described by LŐRENTHEY (1902) from Budapest as *Theodoxus pilari* BRUSINA. However, our form differs from it in being much larger and thicker-shelled and having a more convex labial area with usually smooth margin.

In Fehérvárcsurgó, it is rather rare in Layer 5.

Theodoxus aff. *soceni* JEKELIUS, 1944
(Pl. 4, fig. 4-6)

The shell is small but thick. Juvenile specimens are slim, higher than broad, narrowing below. The adults are wider, elongated oval in outline. Maximum width of the labial area is always at its lower half. Its outer margin is irregular, the inner one is usually finely dentate.

Colour ornamentation was preserved in all of the specimens. The white or light brown ground is covered with dark brown, usually elongated triangular spots pointed towards the aperture. If they are arranged densely, we see abaperturally pointed, white triangles on dark ground. The dark spots are sometimes arranged into axial zones.

This form is very common in Layers 3 and 4.

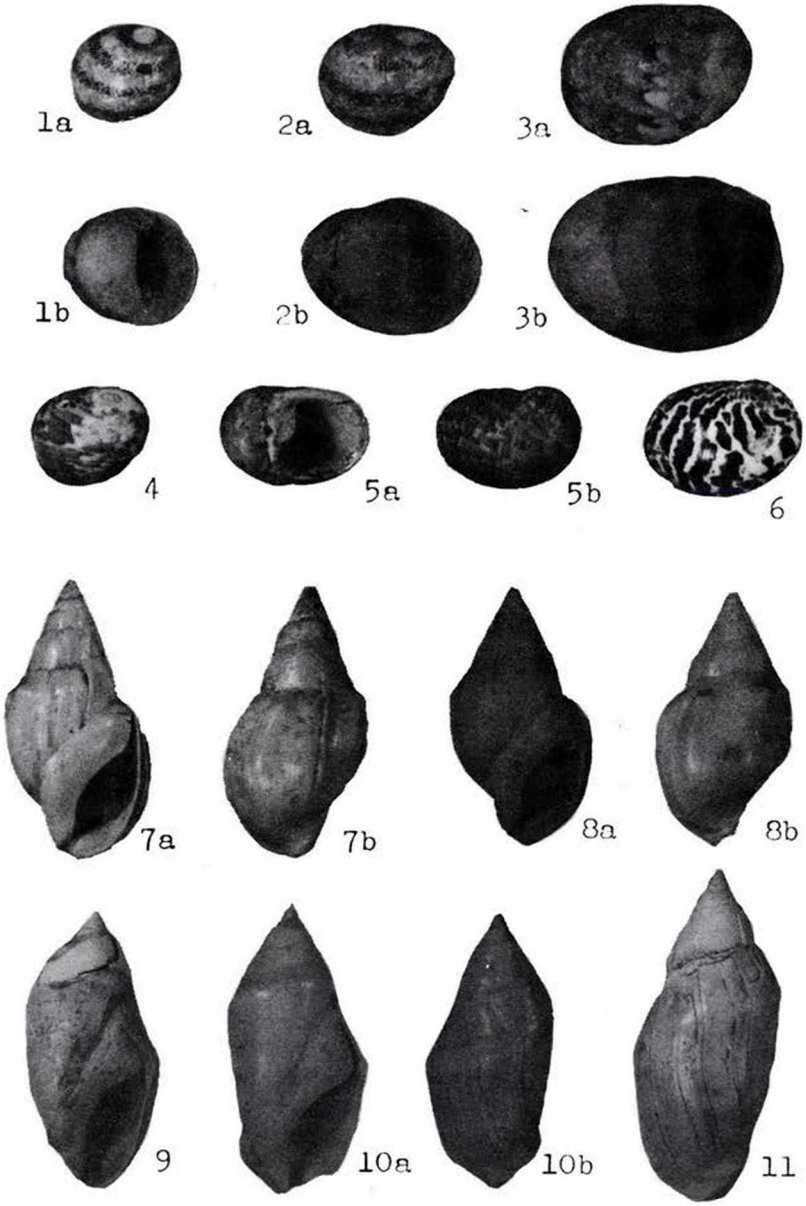

Plate IV.

Fig. 1-3. *Theodoxus intracarpaticus* JEKELIUS 1944. (Fig. 1a, 2a, 3a: 2.5x; fig. 1b, 2b, 3b: 3x)

Fig. 4-6. *Theodoxus* aff. *soceni* JEKELIUS 1944. 4x

Fig. 7-8. *Melanopsis kupensis* FUCHS 1870. 1.5x

Fig. 9-11. *Melanopsis* aff. *impressa* KRAUSS 1852

Valvata aff. *varians* LŐRENTHEY 1902
(Fig. 2)

Valvata varians was described by LŐRENTHEY from Budapest. The Fehérvárcsurgó material markedly differs from it in some features, though the Budapest form is very variable itself. Our specimens are definetely larger and wear not only a spiral angulation but a well-developed carina along the abaxial-adapical part of the last whorl. It also differs from *Valvata subgradata* LŐRENTHEY in having a much shallower umbilicus and lacking abaxial carinae.

This form is very common in Layer 5.

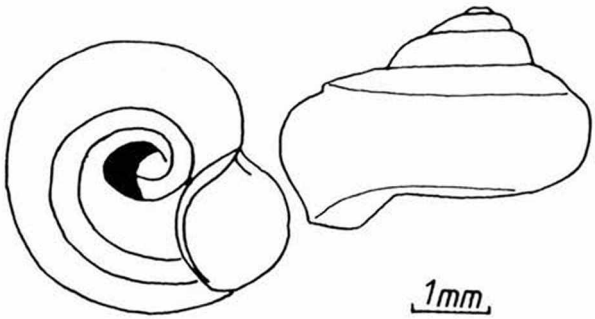

Fig. 2. *Valvata* aff. *varians* LŐRENTHEY 1902

Melanopsis kupensis FUCHS 1870
(Pl. 4, fig. 7,8)

1870 *Melanopsis Kupensis* - FUCHS, p. 544, pl. XXII, fig. 3, 4
1942 *Melanopsis kupensis* FUCHS - STRAUSZ, p. 87, pl. V, fig. 11-13
1963 *Melanopsis kupensis* FUCHS - BARTHA, pl. I, fig. 4.

The type locality of the species is Kúp. It has been found only in the foreland of the Transdanubian Range so far.

The Fehérvárcsurgó specimens are smaller and slimmer than the type. Height of adults is 23.0 to 26.7 mm, their width is 12.2 to 14.7 mm. On the adapical part of the strongly widening last whorl the pustules become more and more elongated, forming costae near the aperture. They are abrupt in the upper and gently sloping in the lower part. In some spcimens, the colour ornamentation can be seen: small, irregular orange spots.

This form can be found in Layer 5; quite rare.

Melanopsis aff. *impressa* KRAUSS, 1852
(Pl. 4, fig. 9-11)

1963 *Melanopsis bonelli bonelli* MANZ. - BARTHA, pl.III, fig. 1.
1963 *Melanopsis impressa* KRAUSS - BARTHA, pl. III, fig. 2

The spire is high, pointed, not gradate. In the adapical third of the last whorl a well-marked spiral angulation can be sen, along which the shell reaches its maximum width.

This form seems to be confined to the "*Congeria ungulacaprae* horizon". STRAUSZ (1942/a) looked upon it as *Melanopsis impressa.*

Though intact specimens are rare, it is quite common in Layer 5.

Gyraulus inornatus (BRUSINA, 1902)
(Fig. 3)

1902 *Planorbis inornatus* BRUSINA - BRUSINA, pl. III, fig. 49-51
1959 *Gyraulus (G.) inornatus* (BRUSINA , 1902) - BARTHA, p. 77, pl. X, fig. 3-5.
1971 *Gyraulus (Gyraulus) inornatus* (BRUSINA, 1902) - GILLET et MARINESCU, p. 59, pl. XXV, fig. 1-9.

A strongly depressed form with a flattened base. Width of the shell is 2 to 4 mm, its height is always less than 0.5 mm. The cornet-shaped apex is surrounded by convex whorls with strong, prosocline growth lines. The umbilicus is wide and shallow. The bases of the whorls are flattened, sloping towards the umbilicus. The growth lines are orthocline here.

This form is common in Layer 5.

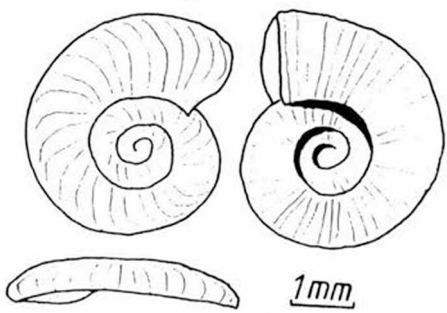

Fig. 3. *Gyraulus inornatus* (BRUSINA 1902)

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